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STUDIES OF THE INHERITANCE OF INTELLIGENCE AND TEMPERAMENT IN DOGS[1/]

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In the fall of 1935, the Bureau of Animal Industry of the U.S. Department of Agriculture started work on a project to study the inheritance of intelligence and temperament in farm animals and their relation to other characters of economic importance. Dogs were used as the experimental animals. Sheepherding was studied as one of the manifestations of intelligence since it was of economic importance in agriculture.

Following former Secretary Wallace's idea of searching for superior germ plasm, four dogs of the Puli breed were imported from Hungary, since this breed has the reputation of being very intelligent sheepherders in their native country. These dogs were interbred to establish a stock of Pulis (in Hungarian, Pulik); they were also crossed to the German Shepherd and Border Collie, as examples of sheepherding breeds in this country, and with the Chow Chow, which was to be used as a control. Later, a pair of Turkish sheep dogs (a gift from the Turkish government) was introduced into the experiment and a litter of puppies raised from them.

Six tests were given each dog: (1) Learning to lead on a leash at 4 months of age; (2) reactions toward sheep, without being trained, at 6 months of age; (3) learning to lie down to one whistle signal and get up and come to the trainer at another whistle signal, in the laboratory, at 8 months of age; (4) training to herd sheep with trainer at 10 months of age; (5) reactions to a stranger in the laboratory at 11 months of age; and (6) reactions in a multiple-choice apparatus in the laboratory at 1 year of age.

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These tests gave results on many characteristics, but because of the war it was necessary to discontinue the project just as it was getting well underway. It has not been possible to analyze most of the data or to draw conclusions as to the value of the tests. A wide variation was found in the reactions of the dogs in all the tests.

Out of 74 dogs given the leash test, 8 percent went readily on the leash in one lesson, 48 percent in two or three lessons, and 29 percent in four to six lessons. Fifteen percent required more than six lessons or did not learn to go readily at all. There did not appear to be any marked differences due to sex or between the larger breed groups.

Only a few dogs learned to lie down to the whistle signals in two or three lessons of eight trials each, with lessons given every other day. A few, however, did not learn in 15 to 20 lessons and had to be given up as hopeless. Most of the dogs did learn to lie down to a single whistle signal in less than eight lessons. There was likewise a great difference in the speed with which the dogs learned to get up and come to the trainer when he blew the whistle twice, after being trained to lie down when he blew the whistle once. The best dogs learned to make this distinction on the first lesson, but the average required five or six lessons. Some of the dogs never learned to make the distinction in as many as 12 lessons. All of the above applies to learning the signals in the laboratory. When the dogs were later given the signals in the sheep pasture or on the road, they generally had to learn all over again, showing that, like children, they tend to learn to respond to a specific situation and find it difficult to generalize.

Results from the "puppy sheep test," in which all or part of a litter of puppies was placed in a small paddock with a few sheep at 6 months of age, indicated quite strongly that dogs which were aggressive toward the sheep at this age remained so unless they were controlled through later training or were made nonaggressive by being hurt by the sheep. Some of the puppies which were afraid of the sheep at 6 months of age, however, later became aggressive toward them. Results indicated that dogs or puppies which were afraid and timid toward the trainer and people were not necessarily so toward the sheep, and vice versa.

Preliminary analyses on the sheepherding test showed that the dogs differed so much in their reactions toward the sheep that they had to be divided into four groups for training and testing: (1) Dogs which were so aggressive toward sheep that they had to be

brought under control by training before they could be allowed off leash with the sheep; (2) dogs which were interested in the sheep but either were not very aggressive or were very easily controlled; (3) dogs which had to have their interest in the sheep stimulated or their courage bolstered by having another dog with them; and (4) dogs which had so little interest in the sheep or were so frightened by them that their interest could not be stimulated by use of another dog. An approximate separation of all the dogs (131) into the four groups gave 18, 41, 16, and 25 percent, respectively. The distribution of the dogs by breed groups, however, differs quite materially from the total. Thus, only 11 percent of the Pulis were in the first group and 36 percent of the Pulis were in the last group. Thirty-seven percent of the German Shepherd X Puli crossbreds were too aggressive and 12 percent showed no interest in the sheep. With our conditions and each dog being given a relatively short training period, approximately 50 percent of the dogs in group 1, 37 percent of the dogs in group 2, and 5 percent of the dogs in group 3 showed definite promise of becoming at least fair sheep dogs if given adequate training. This is approximately one-fourth of all the dogs tested. From our experience in giving additional training in herding to some of the promising dogs, we doubt if we would have been able to make good sheep dogs out of more than half the dogs we thought showed promise.

Quite marked differences were noticeable in the tendency of dogs of the different breeds to harm the sheep under the conditions of the sheepherding test. It is believed this is due to inherited differences in the way the dogs bite. The Collies, for example, seemed to have a tendency to nip the sheep much of the time, rather than really biting them, and thus did little damage. At least some of the German Shepherd X Puli crossbreds seemed to slash and tear when they bit, and this was apt to result in serious wounds. The Turkish dogs, while they sometimes grabbed the sheep, tended to hold on without tearing and seldom injured the sheep.

In an analysis of the behavior of 63 dogs toward a stranger in the laboratory, it was found that the dogs fell into two major groups: (1) Bold, friendly, curious; and (2) suspicious, timid, distrustful. Females were found on the average to be more friendly, bold, and curious toward the stranger than males. There were marked indications that some of the behavior traits were inherited.

In the multiple-choice test, the dog was faced with the problem of finding which one of four doors was unlocked. Since the same door was never right twice in succession, the dog could not successfully go back to the door he escaped from the last time. Each dog was put through the test 140 times. Many of them developed a good system of seeking the right

door, which enabled them to get out of the apparatus with less repetition of doors than would be expected by chance. Preliminary analyses showed that with regard to the avoidance of repetition and the ability of the dogs to escape more quickly than would be expected by chance, the test had fairly high reliability coefficients ($r = 0.82$ and 0.85, respectively). When 44 dogs were scored on avoidance of repetition, a wide distribution of scores from 39 to 80 was obtained. The mean was 56.8 ± 0.9, and the averages for the three largest groups of dogs were: Pulis, 54.3 ± 2.3; F_1 (Pulis X German Shepherds), 62.3 ± 1.3; and F_1 (Pulis X Chows), 55.2 ± 1.5. The mean of the F_1 (Pulis X German Shepherds) was significantly higher than those of the two other groups.

There are, of course, many ways of evaluating the variations in observed behavior. Only by actually trying different methods and testing them with a breeding program over a period of years under controlled conditions is it likely investigators will be able to evaluate correctly the behavior of dogs and develop strains with superior intelligence and temperament.